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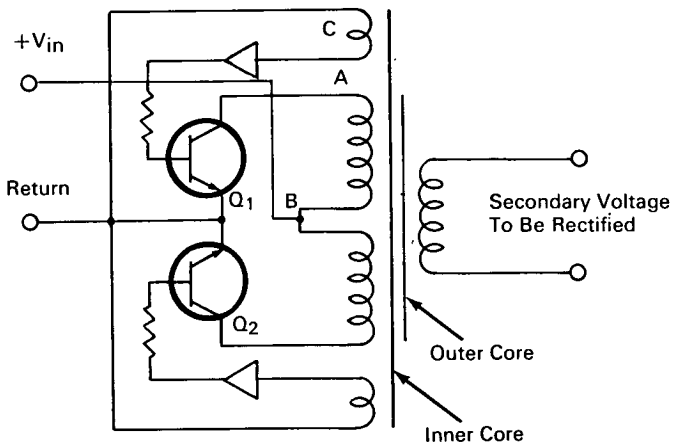
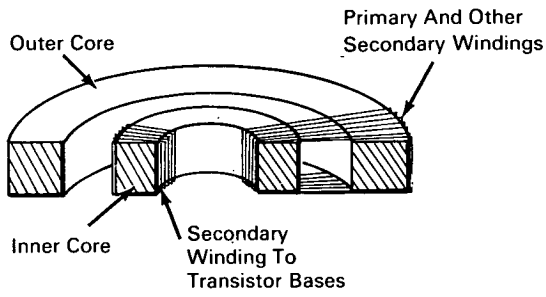
NASA TECH BRIEF

Efficient DC to DC Converter Eliminates Large Stray Magnetic Fields





The problem:

To design a dc to dc converter that provides high switching efficiency and does not produce large stray magnetic fields. As the core switches in conventional converters, the difference between the current available and the load current referred to the primary is used as a magnetizing current. This operation wastes power and produces large ac magnetic fields which can interfere with nearby circuits.

The solution:

A two-core nonsaturating converter that uses one core to provide positive feedback and the combination of the two cores for the transformer.

How it's done:

In order to avoid excessive waste of power and generation of stray magnetic fields, a core must be switched before it saturates. This converter accomplishes this action by using two concentric cores with the same number of magnetizing turns so that the inner core will saturate before the outer core. The inner core provides the positive feedback for switching. To assure that the magnetizing current is the same for both cores, the current in the feedback winding must be negligible. A high input impedance amplifier is therefore used to amplify the feedback signal. If Q_1 is on, there will be a positive voltage applied from B to A and the induced voltage at C will keep Q_1 on. As the inner core saturates before the outer core, the voltage at C collapses and Q_1 turns off. The flux in the inner core begins to change in the other direction, turning Q_2 on. Q_2 will be on until the inner core saturates in the other direction.

After the inner core saturates, the rate of change of magnetizing current does not increase greatly because the flux in the outer unsaturated core can still increase substantially before the latter core saturates. Because the rate of change of magnetizing current has not increased greatly, the transistor will turn off right after saturation of the inner core and switching will occur.

(continued overleaf)

Note:

Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
Goddard Space Flight Center
Greenbelt, Maryland 20771
Reference: B66-10376

Patent status:

No patent action is contemplated by NASA.

Source: Edwin O. Tums
of Enrico Fermi Institute
for Nuclear Studies,
The University of Chicago
under contract to
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